ROLL NO. _____

ALCCS – OLD SCHEME

Code: CS21 **Subject: DATA STRUCTURES & ALGORITHM DESIGN**
Time: 3 Hours **Max. Marks: 100**

AUGUST 2011

NOTE:

- **Please write your Roll No. at the space provided on each page immediately after receiving the Question Paper.**
- **Question 1 is compulsory and carries 28 marks. Answer any FOUR questions from the rest. Marks are indicated against each question.**
- **Parts of a question should be answered at the same place.**

Q.1 a. Let a and b denote positive integers. Suppose a function Q is defined recursively as follows:

$$Q(a,b) = \begin{cases} 0 & \text{if } a < b \\ Q(a-b, b) + 1 & \text{if } b \le a \end{cases}$$

Find the value of Q(14,3). What does this function do?

b. Consider the following arithmetic expression P, written in postfix notation:
P: 12, 7, 3, -, /, 2, 1, 5, +, *, +
Translate P, into its equivalent infix expression.

c. Find out worst-case efficiency, best-case efficiency and average-case efficiency of the sequential search algorithm. Express them using asymptotic notations.

d. Write short notes on Buddy Systems.

e. Describe in brief, Divide-and-Conquer method.

f. Define priority Queues. Explain how priority queues can be implemented.

g. Write a C function that will delete k^{th} element from linear array of size n. **(7×4)**

Q.2 a. Consider a polynomial p(x, y, z) as
$p(x, y, z) = 8x^2y^2z - 6yz^8 + 3x^3yz + 2xy^7z - 5x^2y^3 - 4xy^7z^3$
(i) Rewrite the polynomial so that the terms are ordered. **(3)**
(ii) Suppose the terms are stored in the order shown in the problem statement in the linear arrays COEF, XEXP, YEXP, and ZEXP, with the HEAD node first. Assign values to LINK so that the linked list contains the ordered sequence of terms. **(6)**

b. Write an algorithm for finding solution to Tower's of Hanoi problem. Explain the working of the algorithm for 4 disks. **(9)**

Q.3 a. Consider the following arithmetic infix expression Q.
Q = A + (B * C – (D / E ↑ F) * G) * H
Convert infix expression Q into equivalent post expression using stack. **(8)**

b. Write an algorithm for Binary Search technique. Apply the algorithm on an ordered array A with the following elements {11, 22, 30, 33, 40, 44, 55, 60, 66, 77, 80, 88, 99}. Determine the number of key comparisons made while searching for keys 40 and 85. **(5+5)**

Q.4 a. Define Sorting? Write an algorithm for Insertion Sorting technique. Apply the algorithm to sort the elements
25, 15, 30, 9, 99, 20, 26 **(2+6+4)**

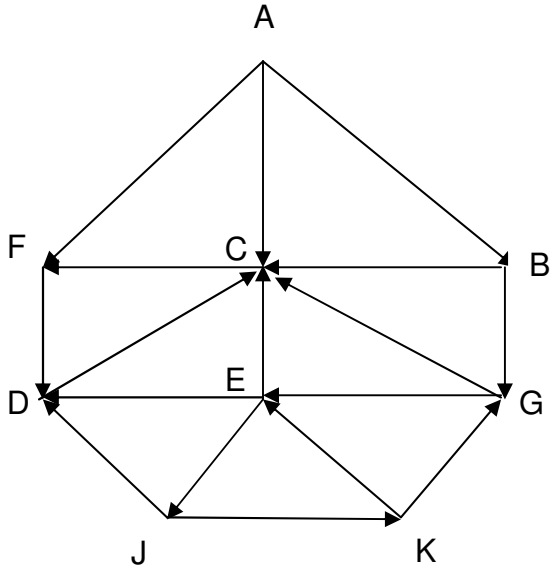
b. Write a recursive function to print the reverse of a string passed to it as an argument. **(6)**

Q.5 a. Define the following:
(i) Complete Binary tree
(ii) Extended Binary tree
(iii) AVL tree **(3×3)**

b. Write a function to reverse the links in a linked list such that the last node becomes the first and the first becomes the last by traversing the linked list only once. **(9)**

Q.6 a. Explain Dijkstra's algorithm for finding the shortest path in a given graph. **(9)**

b. Consider the graph G given below. Apply depth-first search of G starting at J. **(9)**



Q.7 a. Write a C function strend(s, t), which returns 1 if the string t occurs at the end of the string s, and zero otherwise. **(6)**

b. Define maxheap and minheap? How will you represent a max-heap as an array? Write an algorithm to insert an element to a max-heap. **(2+3+7)**